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INTEGRATION OF EXTERNALIZED DECISION MODELS IN THE DEFINITION OF WORKFLOWS FOR DIGITAL PATHOLOGY

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Introduction/ Background

The availability of digital pathology creates opportunities for the adoption of advanced workflow solutions focused on facilitating and improving the current way of working in pathology labs. Workflow-driven applications can help achieve increased efficiency and quality, support collaboration, and provide detailed insights into the lab processes. The implementation of workflow solutions also creates effective means to monitor and measure activities, and to detect and solve issues. Our solution helps improve processes in the pathology lab (both with respect to efficiency and quality) by modeling and optimizing the existing workflows and by incorporating decision models for automatic execution of relevant tasks and path selection in these workflows. Examples of decision models relate to the implementation and automatic execution of protocols, detection of quality issues, and automatic evaluation of tests with image analysis to evaluate the need for pre-ordering additional tests.

Aims

This work focuses on the modeling and optimization of relevant pathology workflows to enable clinical users to efficiently and effectively leverage the deployed digital pathology solutions for faster diagnosis and better patient outcomes. Next to identifying and addressing bottlenecks in the workflow, we aim to improve performance by enriching the workflows with clinical decision support.

Methods

We build a workflow-driven application enabling us to support and propose optimizations for pathology processes, while leveraging the availability of a digital pathology system. We select relevant workflows and identify opportunities for automating tasks and incorporating decision support. The selected pathology processes are represented according to the BPMN standard [1]. We used the jBPM [2] workflow suite (compliant with BPMN 2.0) for the modeling and execution of the processes. Programmatic tasks in the workflows are linked to external services executing the logic required by the tasks.

Results

We proposed a workflow solution enabling the representation of decision models as externalized executable tasks in the process definition. Our approach separates the task implementations from the workflow model, ensuring scalability and allowing for the inclusion of complex decision logic in the workflow execution. In we depict a simplified model of a pathology diagnosis workflow (starting with the digitization of the slides), represented according to the BPMN modeling conventions. The example shows a workflow sequence that automatically orders a HER2 FISH when IHC is borderline according to defined customizable thresholds. The process model integrates an image analysis algorithm that scores images. Based on the score and the thresholds the decision model evaluates the condition and recommends the pre-ordering of an additional test when the score falls between the two thresholds. This leads to faster diagnosis and allows balancing the costs of an additional test versus the overhead of the pathologist by choosing the values of the thresholds.

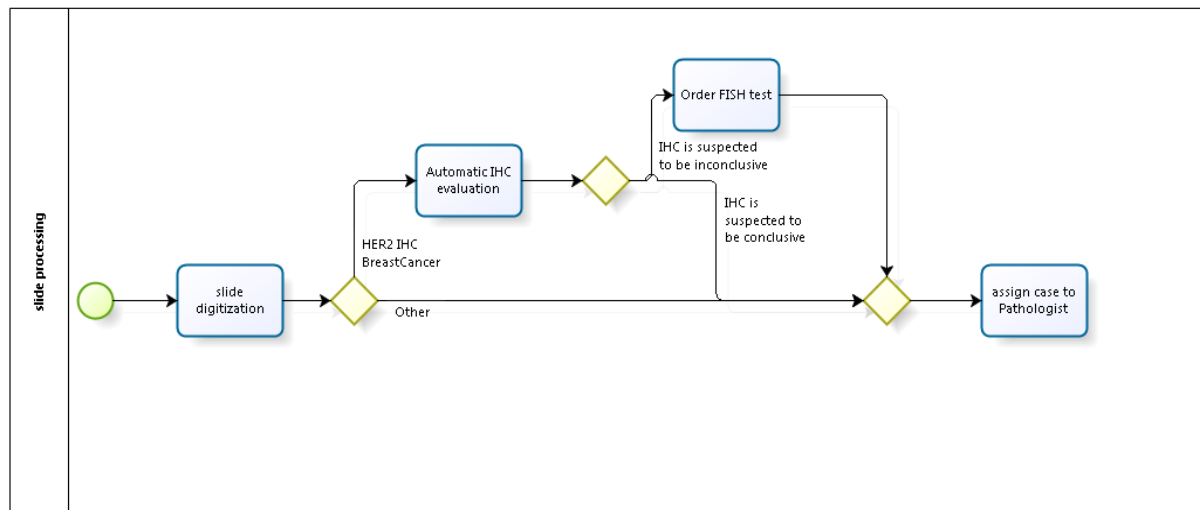


Figure 1.

References:

- [1] Object Management Group, BPMN: Business Process Model and Notation v2.0, 2007, [cited 01-01-2016]. Available from: www.bpmn.org
- [2] JBoss, jBPM Business Process Management Suite, 2015, [cited 01-01-2016]. Available from: www.jbpm.org